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Health Effects Division Standard Evaluation Procedure Analytical Method(s)

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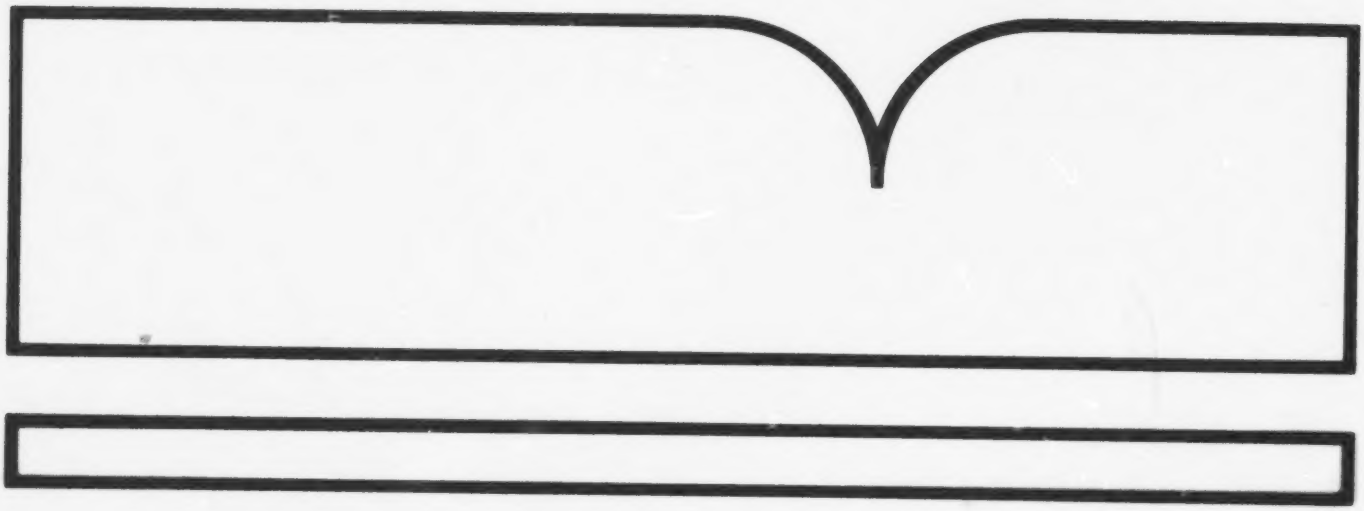

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Analytical Method(s): is designed to aid Dietary Exposure Branch (DEB) data reviewers in their evaluation of analytical method(s) submitted (or referenced) by petitioners/registrants for pesticides and their metabolitie that together comprise the "total toxic residue" in raw and processed commodities.

The term "total toxic residue" is used to describe the sum of the parent pesticide and its degradation products, metabolites (free or bound), and impurities that are considered to be of toxicological significance, and therefore warrant regulation.

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HEALTH EFFECTS DIVISION

STANDARD EVALUATION PROCEDURE

ANALYTICAL METHOD(S)

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ANALYTICAL METHOD(S)

I. INTRODUCTION

A. Purpose of the Standard Evaluation Procedure

This Standard Evaluation Procedure[1/] is designed to aid Dietary Exposure Branch (DEB) data reviewers in their evaluation of analytical method(s) submitted (or referenced) by petitioners/registrants for pesticides and their metabolites that together comprise the "total toxic residue" in raw and processed commodities. These procedures are to ensure that adequate analytical method(s) are available for tolerance enforcement.

The term "total toxic residue" is used to describe the sum of the parent pesticide and its degradation products, metabolites (free or bound), and impurities that are considered to be of toxicological significance, and therefore warrant regulation.

B. Background Information

As stated in 40 CFR 158.240:

> "A residue method for enforcement of tolerances is needed whenever a numeric tolerance is proposed. Exemptions from the requirement of a tolerance will also usually require an analytical method. Analytical methods used to enforce residue limits for emergency exemptions, temporary tolerances and permanent tolerances must be available for use by enforcement agencies and thus may not be claimed as confidential business information."

1/ Other topic areas considered in residue chemistry data review (ref. 40 CFR 158.240) will be addressed in separate Standard Evaluation Procedure documents.

Specifically, appropriate and adequate analytical method(s) for the "total toxic residue" (either for the individual components or for the whole) are needed for:

- The analysis of residue samples (raw agricultural commodity (r.a.c.) and, where appropriate, processed foods and feeds) from supervised trials conducted to provide data to support a proposed tolerance (or exemption) action;
- The analysis of samples from storage stability validation studies conducted to authenticate the supervised trial samples;
- Support of practical methods (e.g., trimming, washing, etc.) for removing residues that exceed any proposed tolerances; and,
- Enforcement of established tolerances for pesticides (and their metabolites that together comprise the "total toxic residue").

C. Objective of Analytical Method(s) Development

Suitable and appropriate analytical method(s) should satisfactorily answer the following question: Is this methodology adequate for residue data gathering purposes and/or for the enforcement of the proposed tolerance(s) of the "total toxic residue" in the commodities of concern?

II. INFORMATION TO BE SUPPLIED

The petitioner/registrant's report(s) of the analytical method(s) to detect pesticide residues (the "total toxic residue") in/on a raw agricultural commodity (or, where appropriate, processed foods/feeds) should include all information necessary to provide a complete and accurate description of each test commodity (sample preparation); each test compound (analyte of interest); residue method(s) and instrumentation; analytical methodology residue results and reporting of the data; statistical analyses; and, quality control measures/precautions taken to ensure the fidelity of these operations.

A guideline of specific information that should be included in the petitioner/registrant's report of analytical method(s) is provided in the Agency Data Reporting Guideline on Analytical

Method(s)[2/] that complements this Standard Evaluation Procedure. Related information on Storage Stability, the Magnitude of the Residue in Crop Field Trials and in Processed Foods and Feeds are found in the Standard Evaluation Procedures [2/] and Data Reporting Guidelines [2/] on those subject areas.

III. THE DATA EVALUATION PROCESS

A. Prepare A Summary

The initial step in the evaluation process of analytical method(s) for pesticide residues in/on a raw agricultural commodity (or processed food/feed) is for the reviewer to carefully examine and summarize the information/data supplied by the petitioner/registrant in his submission to the Agency. Statistical treatments of the data should be independently verified and the quality control precautions noted.

B. Identify Data Gaps

Using the Data Reporting Guideline on Analytical Method(s) as a guide (in conjunction with other related Data Reporting Guidelines), the reviewer should then look for data gaps--omissions in the information supplied by the petitioner/registrant in his report. These should be duly noted in the reviewer's report, and a judgment made as to which are considered significant enough to adversely affect the review process. Those so identified should be communicated back to the petitioner/registrant by the Product Manager for corrective action.

C. Assess the Appropriateness and Adequacy of the Data

The data reviewer then considers the appropriateness [vis-a-vis the currently available enforcement method(s), if there are such] and adequacy of the data/information that has been

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2/ Available from the National Technical Information Service.

supplied. The previously cited Data Reporting Guidelines are a useful guide to the various parameters that need to be considered. Appendix 1 of this document discusses specific aspects of those parameters that warrant consideration.

As an adjunct to these, the reviewer should draw upon the technical guidance in the reviewer aids materials that are available, such as the Residue Chemistry Guidelines (a.k.a. Subdivision O of the Pesticide Assessment Guidelines). A listing of some suggested source materials is located in Appendix 2 to this document.

Any perceived deficiencies in the data/information supplied should be identified and explained, with a statement as to what steps should be taken to resolve the deficiencies, so that this information can be relayed back to the petitioner/registrant by the Product Manager for appropriate action.

D. Determine the Need for a Method Trial and the Availability of Reference Standards

In reviewing the residue analytical method(s) that has/have been submitted, the data reviewer must decide if a method trial by Agency chemists of the submitted method(s) is required. (See p. 11 for additional information on this subject.)

If so, the data reviewer must ascertain if the necessary pesticide analytical reference standards for the compounds to be tested have been supplied by the applicant to the Pesticide and Industrial Chemicals Repository, Research Triangle Park, NC. If not, the data reviewer should contact the applicant and remind him of the need to supply the necessary pesticide analytical reference standards (see §171-13 of the Pesticide Assessment Guidelines, Subdivision O - Residue Chemistry and 40 CFR 158.240(a)).

E. Determine the Need for Consultation(s)

In considering the appropriateness and adequacy of the analytical method(s) that has/have been supplied, the data reviewer must also determine if consultation(s) with other relevant sources (e.g., BEAD/OPP, RTP/EPA, FDA, FSIS/USDA, etc.) is/are germane to reaching that decision.

If so, the specific nature of the consultation(s) should be clearly and succinctly stated and directed to the specific parties whose input is sought.

In the interim period until consultation(s) is/are complete, final judgment on the issue(s) in question should be withheld.

F. Conclude If the Analytical Methodology is Supportive of the Requested Action

Lastly, the reviewer considers the theory, procedure, validation, specificity, sensitivity, time and equipment/instrumentation requirements, and other relevant parameters for the analytical method(s) (such as availability of reference standards; e.g., parent compound, any metabolite(s) that are considered of toxicological concern, derivatives of these that are needed to help validate the method, etc.), and makes a judgment as to whether they support the requested action (tolerance/registration) of the data submitter and if the methodology is suitable for enforcement.

If the analytical methodology is not supportive, possible alternative action(s) that may be taken by the petitioner/registrant are suggested. If deficiencies/omissions exist in the submitted analytical method(s), the reviewer may have to defer judgment until such time as appropriate corrective action has been rendered by the petitioner/registrant.

(Note: As stated in (D) above, if consultation(s) with other sources or method trial request(s) has/have been made, final judgment will need to be held in abeyance pending the outcome of these actions.)

IV. REVIEWER AIDS

There are a large number and variety of source materials available to assist the data reviewer in the evaluation process. A listing of some of the more useful references that reside within the Branch is provided in Appendix 2 to this document.

APPENDIX 1

MAJOR POINTS TO CONSIDER IN EVALUATING ANALYTICAL METHOD(S)

Include the following:

A. The Test Commodities [Sample Preparation]

- What specific matrices [e.g., plant or animal parts] were subjected to residue analysis for a determination of the "total toxic residue"?
- Were all the appropriate matrices [including processed commodities, if any] subjected to residue analysis? [Ref. Table II, Residue Chemistry Guidelines.]
- Were all matrices analyzed on which tolerance(s) are proposed? - Were the r.a.c. samples in any way trimmed, cleaned, or otherwise subjected to a means of residue removal in preparation for the analysis of the "total toxic residue"? If so, were the recommended procedures of P.A.M. I, §§ 141-2 followed?
- Was any sample compositing or subsampling done in preparation for analysis of the "total toxic residue"? If so, were details given? Were the same sample code numbers maintained?
- Was the sample/laboratory coding sufficiently clear so that the history of the sample(s) could be traced [e.g., treatment regimen, harvest date (if applicable), length of storage, extraction date, etc.]?
- Were control samples [field blanks, reagent blanks] carried through the analytical procedure?
- Does the method require use of an untreated commodity blank to ensure reproducible results? If so, can the method be revised to eliminate this step? Will such a revision necessitate a method trial?
- Were split samples from field trials submitted by the petitioner to EPA for analysis? Were the results comparable? If not, does this invalidate the study?
- For split samples, was the split a portion of a sample previously analyzed, or was the split a duplicate sample?

B. The Test Compound(s) (Analyte(s) of Interest)

- Were analytical reference grade standards of the parent pesticide and any metabolite(s) of special concern [normally

those which, in addition to the parent, comprise the "total toxic residue"] used for fortification of control samples and instrument calibration? Were the purity and stability of these standards given? Information on storage conditions [e.g., temperature, type container, etc.]?

- Is it described how the test compound(s) were prepared for the fortification process [i.e., what solute(s), concentration of the standard solution(s), dilution factors, etc.] of control samples, and as instrument standard(s)?
- If a mixture of test compounds [i.e., standards] was used in "spiking" the control samples and/or in calibrating the instrument(s), was testing done to ensure that interference would be no problem?

C. Residue Method(s) and Instrumentation

- Was more than one analytical method used in the analysis of treated samples [e.g., raw or processed food/feed commodities] for the "total toxic residue" [i.e., a "total" residue method and perhaps separate method(s) for the metabolite(s) of concern]?
- Were the analytical method(s) used for gathering the residue data the same as those proposed for enforcement? If not, are there significant differences that would warrant a paired-test comparison or a method trial?
- Were the analytical method(s) adequately identified [e.g., title/designation/date and source]?
- Is a complete [non-CBI] copy of each analytical method that was used in the determinations of the "total toxic residue" provided [or available in the over-all data package] with a description of the principles and the stepwise procedure [extraction, clean-up, derivatization, determination, confirmation], and is it clear what chemical species could be determined?
- Is it clear if modifications were made in the analytical procedure(s) used in analyzing the residue samples and, if so, are they adequately described?
- Was the extraction efficiency of the analytical method(s) demonstrated [especially if dry r.a.c. or processed substrates or aged residue samples were used, or if the presence of "bound" residues is suspected]? If dry substrates were used, is the means of rehydration adequately described? If "bound" residues are suspected, were hydrolysis/cleavage procedures/conditions used? Adequately described?
- Were the method(s) tested on samples derived from the radiolabeled plant and/or animal metabolism studies to determine extraction efficiency and percent of total residue determined by the method(s)?

- Were method sensitivity and the limit of detection given? Were they suitably low?
- Was an internal standard used? If so, was the internal standard identified? Was the internal standard of similar structure, solubility, and stability to the analyte(s) of interest? Have the extraction, clean-up, and determination efficiencies between the analyte(s) of interest and the internal standard demonstrated they are statistically identical throughout the entire analytical procedure? Has the petitioner shown by LC or GC chromatograms that the internal standard and analyte(s) of interest are completely resolved and elute in known windows where no coextractives or other registered pesticides coelute?
- Were any difficulties encountered in the procedure(s) [e.g., emulsions, etc.] and, if so, were they adequately described and overcome?
- Were any confirmatory procedures used? If so, is a copy of these provided in the data submission package? Sufficiently described?
- Were any esoteric reagents/equipment/instrumentation used? Would these make the procedure(s) unsuitable for enforcement purposes? Can the procedure(s) be suitably modified so as to avoid the problem?
- Are all reagents/equipment/instrumentation readily available commercially? Are the suppliers indicated? Were any modifications made by the applicant? If so, are these adequately described?
- Are the test chemical(s) recovered by any of the multi-residue schemes that FDA and USDA routinely use in their enforcement programs?
- Are the instrumentation [type, type/specificity of detector(s), column(s) (size, packing materials), carrier gas(es), etc.] and operating parameters [flow rate(s), temperature(s), voltage, etc.] specified? Adequately described?

D. Analytical Methodology Residue Results

- Was a second lab validation of the method(s) performed? If so, are results comparable? If not, should EPA's petition method validation (PMV)/method trial be started?
- Were blank values reasonably low? If not, is an explanation provided?
- Were any correction factors [e.g., method recovery, extraction efficiency, field blanks, storage stability] applied to the residue values reported?
- Are all the raw data reported rather than just average values?
- Are the method(s) of calculating the residue values adequately described [formulae, standard curves, etc.], and illustrated, and the raw data sufficiently detailed so that

independent calculations to verify the reported results can be made?
- Were the residue values reasonably uniform for replicate samples?
- Were representative chromatograms, spectra, etc., as applicable, provided for both fortified and blank samples, and standards? Are adequate clean-up and determination [i.e., low background "noise", adequate signal-to-noise ratio, well-defined peaks rather than shoulder bands, etc.] of the test compound(s) indicated? Is the level of claimed sensitivity valid?
- How do results obtained via these analytical procedure(s) compare to results obtained for the same pesticide using alternate method(s) [if such data are available]?
- Are the analytical method(s) submitted by the petitioner/registrant suitable for purposes of gathering the residue data? For enforcement purposes?
- If the analytical method(s) used are not already in the PAM, should they be recommended for inclusion therein? If so, should this be done as roman numeral or as alphabetical designation?

E. Quality Control

- Were the analytical method quality control objectives stated?
- Were the stated objectives met? If not, how does this affect the results of the supervised trial samples and the ability of the method to enforce tolerances?
- What quality assurance measures were taken to ensure the fidelity of the analytical methodology residue analyses [e.g., instrument log books, etc.]?
- Were the analyst's worksheets provided? Are they sufficiently detailed?
- From the analyst's worksheets, was the sample/laboratory coding sufficiently clear so that the history of the sample(s) could be traced (i.e., "chain of custody")?
- Were the person(s) [supervisor, analyst] responsible for the analytical method(s) residue analyses identified [name, title, organization, address, and telephone number]?
- Are the calibration procedures for the instrumentation described?
- Were tests performed for interference from storage containers, reagents, plant or animal substrates, plastic labware, etc.? Other registered pesticides?
- Were any interferences noted in the determination of the "total toxic residue"? If so, was the nature of the interference identified? Were steps taken to resolve the interference, and were they successful?

- If statistical analyses were performed and applied to the results of the analytical method(s) residue determinations, is sufficient information provided to independently validate the results?
- Is it clear at what step in the analytical methodology the fortification occurred, and how this was accomplished?
- Were there accompanying analytical method(s) validation/recovery test data for the analysis of r.a.c. samples from each individual crop field trial (or processing study)?
- Are all the significant dates given [e.g., dates of extraction, analysis and determination; sample history information with treatment dates, harvest dates, storage dates, etc.]?
- How long did it take the analyst to run a sample completely through the analytical procedure(s), including the determinative step? A sample set? Is the minimum time to run a sample/sample set indicated? Are these timeframes acceptable?
- Are there any long steps (hydrolysis, etc.) in the analytical procedure(s)? If so, is length based on convenience or necessity? Is the minimum time required to run such steps indicated?
- What specific matrices [e.g., plant or animal parts, or processed commodities therefrom] were subjected to residue analysis for a determination of the "total toxic residue"?
- Were the analytical method(s) suitable for all the matrices of interest for which tolerances are proposed? If not, were suitable modifications employed?
- Were all the appropriate test matrices [including processed commodities, if any] subjected to residue analysis? [Ref. Table II, Residue Chemistry Guidelines.]
- Were all test matrices analyzed on which tolerance(s) are proposed?
- In what form [whole, chopped, extract, etc.] were the test matrices when they were fortified?
- Were all the necessary compounds [parent plus metabolite(s) comprising the "total toxic residue"] and test matrices [specific parts] tested in the analytical method(s) validation/recovery study?
- Were the number and magnitude of the fortification levels adequate and appropriate?
- Are the analytical method(s) suitably specific/selective and sensitive for the analyte(s) of concern?
- Are the write-up(s) of the analytical method(s) suitably detailed, and are special precautions or techniques required?
- Is there a Registration Standard for the pesticide and, if so, is it being used in the evaluation of the analytical method(s)?
- Is a need for a laboratory audit indicated?

F. Method Trial Requests and Reports

- Are there enforcement method(s) for this pesticide [and its metabolites that together comprise the "total toxic residue" of concern] in PAM I or II? If so, reference [petition(s), report date(s), matrix(es), fortification level(s), etc.] and discuss previous method trial(s) that have been conducted. If not, has the necessary method trial request been initiated?
- Have the necessary reference standard(s) been received by the Pesticide Repository of EPA? By the EPA methods trial laboratory? If not, has the petitioner/registrant been reminded that this must be done?
- If enforcement method(s) are available, is there a need for an additional method trial? If so, explain why.
- If apropos, has the analytical methodology been tested on matrices that are:
  - ° high oil type samples, e.g., soybeans, peanuts, etc.;
  - ° high moisture vegetation samples, e.g., lettuce, tomatoes, etc;
  - ° high sugar type samples, e.g., fruits, etc.,
  - ° low moisture type samples, e.g., dry hays, dry grains, etc.;
  - ° of animal origin, e.g., milk, liver, poultry tissues, etc..

  If such testing has not been done, is it warranted at this time? Explain.
- Would the present enforcement method(s) [if any] recover the analyte(s) of concern from the matrix(es) of interest? If yes, was it necessary to modify the procedure(s) to accomplish this? If yes, are the details of the modification(s) explained? Modified procedure(s) appropriately validated?
- Are all the metabolite(s) of toxicological significance recoverable by the proposed enforcement method(s) from the matrix(es) of interest? From analytically similar matrix(es)? If not, has the petitioner been advised of the need for such method(s) to support the proposed tolerance(s)?
- Is the analytical methodology that was used to gather the residue data significantly different from the enforcement method(s)? If so, is a new method trial justified?
- After reviewing the PAM II analytical procedure(s) and the analytical procedure(s) in the petition under review, are the PAM II procedure(s) still the procedure(s) of choice for enforcement? If not, explain the reasons why, and initiate a method trial request to validate the preferred analytical procedure(s) for enforcement purposes.

- Have the PAM II Editors been notified of improvements to the existing enforcement method(s) [e.g., initial digestion, change in clean-up procedure(s), increased sensitivity, more selective/sensitive detector, etc.] which would not justify a new method trial but which do warrant inclusion in PAM II?
- Is a new method trial advisable based on the proposed [e.g., very low level or limit of detection, level significantly higher than previous method trial, etc.] tolerance? If yes, explain.
- Have copies of all appropriate chromatograms been submitted with the method trial report? If not, what is the explanation for this?
- In the method trial report, were results of control or blank samples reported? Limit of detection identified or confirmed? Level of sensitivity (quantitation) identified or confirmed? Coextractive residues noted and, if so, identified and explained?
- Has the method trial report been reviewed for possible errors in calculation? Preparation of standards? Chromatographic operating parameters? Etc.?
- Are there enough data for a statistical evaluation? If so, are the reported results of the method trial statistically acceptable? If not, should the method trial be repeated? Submitted to another regulatory federal or state laboratory for confirmation?
- If the method trial report indicates the petitioner's analytical method(s) are questionable in recovery of the analyte(s) of interest or in any procedural step, are consultation(s) with FDA and/or USDA appropriate?
- Does the method trial report indicate the method trial was successfully completed and with adequate recoveries? If deficiencies were encountered, has the petitioner been advised? Been given the opportunity to make suggestions or provide modifications?
- Did the method trial report meet the projected petition due date? If not, was the Branch notified of problems being encountered, and of the probable completion date? Was the Product Manager kept advised of developments?
- Does the method trial report list any new special precaution(s) to be followed that have not previously been identified by the petitioner?
- Has a critical evaluation of the method trial report been prepared? Does the method trial report respond to the method trial request (i.e., was the method submitted the one actually tested)? Give percent recoveries? Present all raw data? Give statistical treatment(s)? Show at least duplicate determinations per test level? Does it agree with the petitioner's validation? Does it provide

explanation(s) of any modification(s) made to the petitioner's method(s)? If the method(s) tested required significant changes (i.e., different amounts, solvents, etc.) has the petitioner been requested to submit a new method reflecting these changes?

- Has a transmittal letter (with relevant attachments) to the FDA technical editing group for the PAM been prepared for the method(s) package? Has a copy (with pertinent attachments) been sent to PMSD?

REFERENCES

Following is a listing of some of the more useful source materials within the Branch that could prove helpful in reviewing analytical methodology submitted by petitioner/registrant(s):

(1) F.D.A. Pesticide Analytical Manual, Volumes I and II, available from the National Technical Information Service, Springfield VA (updated periodically);

(2) Official Methods of Analysis of the Association of Official Analytical Chemists, 13th ed., W. Horwitz (editor), Association of Official Analytical Chemists, Washington, D.C. (1980);

(3) Chemistry Laboratory Guidebook, USDA, FSIS, Science, available from the National Technical Information Service, Springfield, VA;

(4) Basic Gas Chromatography, H. M. McNair and E. J. Bonelli, Consolidated Printers, Berkeley, CA (1969);

(5) Gas Chromatography Principles, Techniques and Applications, A. B. Littlewood, Academic Press, NY (1962).

(6) High Resolution Gas Chromatography, 2d ed., R. R. Freeman, Hewlett Packard Company (1981);

(7) Introduction to Modern Liquid Chromatography, 2d ed., L. R. Snyder and J. J. Kirkland, John Wiley and Sons, Inc., NY (1979);

(8) Practical Liquid Chromatography, R. W. Yost, et al., Perkin-Elmer, Norwalk, CT (1980);

(9) Instrumental Methods of Analysis, 5th ed., H. H. Willard, et al., D. Van Nostrand Company, Inc., Princeton, NJ (1974);

(10) Interpretation of Mass Spectra, 3d ed., F. W. McLafferty, University Science Books, Mill Valley, CA (1980);

(11) Applications of Absorption Spectroscopy of Organic Compounds, J. R. Dyer, Prentice-Hall, Englewood Cliffs, NJ (1965);

(12) Systematic Identification of Organic Compounds, R. L. Shriner, et al., John Wiley and Sons, Inc., NY (1965);

(13) Spectrometric Identification of Organic Compounds, 4th ed., R. M. Silverstein, et al., John Wiley and Sons, Inc., NY (1979);

(14) Organic Structural Analysis, J. B. Lambert, et al., MacMillan Publishing Company, Inc., NY (1976);

(15) Principles of Radioisotope Methodology, 3d ed., G. D. Chase and J. L. Rabinowitz, Burgess Publishing Company, Minneapolis, MN (1967);

(16) The Identification of Functional Groups in Organophosphorous Compounds, L. C. Thomas, Academic Press, London, England (1979).

(17) Various reference texts and journal publications of a scientific or agricultural nature, including FAO/Codex Monographs; Residue Reviews (assorted volumes); Analytical Chemistry (assorted issues); Journal of Agricultural and Food Chemistry (assorted issues); Journal of the Association of Official Analytical Chemists (assorted issues); The Analyst (assorted issues); Journal of High Performance Chromatography (assorted issues);

(18) EPA Analytical Reference Standards and Supplemental Data, available from the National Technical Information Service, Springfield, VA;

(19) FDA Laboratory Information Bulletins, available from the National Technical Information Service, Springfield, VA;

(20) EPA Manual of Analytical Methods for the Analysis of Pesticides in Humans and Environmental Samples, available from the National Technical Information Service, Springfield, VA;

(21) Chemical Separations and Measurements, D. G. Peters, et al., W. B. Saunders Co., Philadelphia, PA (1974);

(22) Biological Applications of Liquid Scintillation Counting, Y. Kobayashi and D. V. Maundsley, Academic Press, NY (1978);

(23) Statistical Methods Applied to Experiments in Agriculture and Biology, 7th. ed., G. W. Snedecor, Iowa State College Press, Ames, IA (1980);

(24) Statistical Manual of the Association of Official Analytical Chemists, W.J. Youden and E.H. Steiner, Association of Official Analytical Chemists, Arlington, VA (1975);

(25) Subdivision O [Residue Chemistry] of the Pesticide Assessment Guidelines, § 171-3 and § 171-4, prepared by OPTS/EPA, Washington, D.C. (1982);

(26) Subdivision D [Product Chemistry] of the Pesticide Asses sment Guidelines, prepared by OPTS/EPA, Washington, D.C. (1982);

(27) Code of Federal Regulations [40 CFR 158, 180, 185, and 186], General Services Administration, Washington, D.C., updated annually;

(28) Pesticide Chemical News Guide, R. E. Duggan, editor, Food Chemical News, Inc., Washington, D.C., 1982, updated monthly;

(29) "Guidelines on Pesticide Residue Trials to Provide Data for the Registering of Pesticides and the Establishment of Maximum Residue Limits", FAO Plant Protection Bulletin, 29:1/2, pp. 12-27 (1981);

(30) "Guidelines for Data Acquisition and Data Quality Evaluation in Environmental Chemistry", Anal. Chem. 52, 2242-2248 (1980);

(31) Chemistry Quality Assurance Handbook, Vols. I and II, USDA, FSIS, Science, available from the National Technical Information Service, Springfield, VA;

(32) Acceptable Common Names and Chemical Names for the Ingredient Statement on Pesticide Labels, 4th ed., C. R. Blalock, et al., editors, OPP/EPA, 1979, available from National Technical Information Service, Springfield, VA;

(33) Farm Chemicals Handbook, Meister Publishing Co., Willoughby, OH, updated annually;

(34) Nanogen Index: A Dictionary of Pesticides and Chemical Pollutants, K. Packer, editor, Nanogens International, Freedom, CA, 1975 (updated periodically by supplements);

(35) The Pesticide Manual, 7th ed., C. R. Worthing, editor, The British Crop Protection Council, The Lavenham Press Limited, Lavenham, England (1983);

(36) Registration Standards on various individual pesticides, prepared by OPTS/EPA, (several issued each fiscal year);

(37) Branch files: petition and registration files; reviewer aids; policies; subject files; reading files; et al..